48. (Amended) A communication system as defined in claim 46, wherein said [filters are a] plurality of filters are provided for [a plurality of] the [corresponding] carrier signals so formed on the sender side as to satisfy orthogonal requirements other both on the axis of frequency and the axis of time, the central frequencies of said plurality of filters being frequencies of said carrier signals and said filters satisfying orthogonal requirements both on the axis of frequency and the axis of time.

REMARKS

By this response, claims 1-48 are pending, of which claims 3, 5, and 11-13 are cancelled, and claims 1, 2, 4, 6-10, 14-19, 21-24, 27-30, 33, 34, 36-45, and 48 are amended. Claims 2, 4, 6-8, 10, 14, 15, 17-19, 21-24, 27-30, 33, 34, 36-45, and 48 are amended to correct grammatical errors and to clarify claim scope but the claim scope is not narrowed thereby for any reason relating to patentability. Claim 10 is rewritten in independent form. Claims 1 and 9 are amended to further clarify claim scope. Care has been exercised to avoid the introduction of new matter. Adequate descriptive support for the amendment can be found in the specification.

The Office Action of August 15, 2001 rejected claims 1-2 and 9 under 35 U.S.C. § 102(b) as being anticipated by Hayashino (U.S. Patent No. 5,682,376), claims 3-8 and 10-48 under 35 U.S.C. § 103(a) as being unpatentable over the same reference in view of Hyll (U.S. Patent No. 6,005,893), and objected to claims 1-4, 9, 14, 28 and 29 under 35 U.S.C. § 112, second paragraph as being indefinite for lacking antecedent basis. The rejections and objection are respectfully traversed in light of the remarks presented herein.

Rejections under 35 U.S.C. § 102(b)

Claims 1-2 and 9 were rejected as being anticipated by Hayashino. The rejection is respectfully traversed because the cited reference fails to establish a prima facie case of anticipation.

To establish a *prima facie* case of anticipation under 35 U.S.C. § 102, a single prior art reference must describe each and every element as set forth in the subject claim.

Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Hayashino, however, fails to disclose every limitation of the claims.

For example, claim 1, as amended, describes a transmitter for converting **an** input signal into carrier signals orthogonal to each other in the frequency domain by modulating a plurality of carriers. The carrier signals are then transmitted to the receiver side via a transmission line. Since the **same** input signal modulates a plurality of carriers, the resulting modulated signals contain the **same** signal content (see Figs. 2 and 7). Claim 9 describes, in addition to the features of claim 1, that the carrier signals are also orthogonal in the time domain.

In rejecting the claims, the Office Action indicated that OFDM (Orthogonal Frequency Division Multiplexing) systems used in Hayashino are similar to the claimed invention. The Applicants respectfully disagree.

OFDM systems divide an input signal into a plurality of segment signals and use the segment signals to modulate a plurality of orthogonal carriers in the frequency domain. Therefore, in OFDM, the carriers are modulated by **different signals** (segment signals). In contrast, both claims 1 and 9 require using the same input signal to modulate a plurality of carriers. Therefore, Hayashino does not teach or describe "a sending signal generating means for converting **an** input signal into carrier signals that do not interfere with each other."

In addition, claims 1 and 9, as amended, describes "a selection control means for controlling the intensity distribution of said carrier signals according to the transmission characteristics of said carrier signals detected on the receiver side." Nowhere did Hayashino describe this feature. Therefore, Hayashino does not teach every limitation of claims 1 and 9, and thus fails to establish a prima facie case of anticipation. Accordingly, the anticipation rejection in untenable and the rejection should be withdrawn.

Claim 2 incorporates every limitation of claim 1. Based on the same reasons discussed in claim 1, the anticipation rejection should be withdrawn as well.

Rejection under 35 U.S.C. § 103(a) is traversed

Claims 3-8 and 10-48 were rejected as being unpatentable over Hayashino in view of Hyll. Claims 3, 5, 11-13 are cancelled by the present amendment. The rejection to the claims are now moot. The rejection of claims 4, 6-8, 10, and 14-48 is respectfully traversed because the references, even combined, fail to establish a prima facie case of obviousness.

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Second, there must be some suggestion or motivation in the references themselves to modify the reference or to combine reference teachings. Third, there must be a reasonable expectation of success for the modification or combination of references. Further, the teaching or suggestion to make the modification or combination of prior art and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Additionally, there must be particular finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge to the claimed invention to combine or modify references. *In re Kotzab*, 217 F.3d 1365, 55 U.S.P.Q.2d 1313 (Fed. Cir. 2000). Hayashino and Hyll, even combined, fail to disclose every limitation of the claims.

Claims 4 and 6-8 incorporate every limitation of claim 1 and claim 10 incorporates every limitation of claim 9. As discussed above, Hayashino fails to disclose "a selection control means for controlling the intensity distribution of said carrier signals according to the transmission characteristics of said carrier signals detected on the receiver side," as required by claims 1 and 9.

Hyll does not alleviate this deficiency. Hyll is related to a multi-channel transmission for sending signal bits. The signal bits are divided into a plurality of bit segments and transmitted in different sub-channels by modulating carriers with different frequencies. Sub-channels are assigned different numbers of bits based on the transmission quality of that sub-channel: more bits are assigned to sub-channels with high transmission quality and vice versa.

Hyll discloses only allocating different numbers of bits to different sub-channels and fails to disclose "a selection control means for controlling the intensity distribution of said carrier signals according to the transmission characteristics of said carrier signals detected on the receiver side," as required by the claims.

In addition, both Hayashino and Hyll fail to teach or suggest "converting an input signal into a plurality of carrier signals that do not interfere with each other both on the axis of frequency and the axis of time," as required by claim 9. Thus, Hayashino and Hyll, even combined, fail to disclose every limitation of the claims.

Claim 14 describes "a transmission line characteristics measuring means for receiving carrier signals that the sender send in after converting an input signal into said carrier signals,...wherein said carrier signals are generated based on the **same** input signal." As discussed in claim 1, both Hayashino and Hyll use different input signals to modulate a plurality of carriers.

Claims 15-18 depend form claim 14 and further describe "controlling the intensity distribution of said carrier signals according to the transmission characteristics of said carrier signals." As discussed above, Hyll discloses only allocating different numbers of bits to different sub-channels and fails to disclose "controlling the intensity distribution of said carrier signals," as required by the claims. Thus, the references, even combined, fail to disclose every limitation of claim 14 and its dependent claims.

Claim 28 describes a communication system having limitations similar to those of claims 1 and 14. For the same reasons discussed above, the cited references fail to teach or suggest every limitation of claim 28 and its dependent claims.

Hayashino and Hyll, combined, also fail to disclose limitations described in claim 29. Claim 29 describes "a plurality of filters for, with said plurality of divided input signals as input, outputting a plurality of signals, said plurality of signals satisfying the orthogonal requirements both on the axis of frequency and the axis of time." As discussed above, Hayashino does not have this feature.

Hyll describes a parallel-to-serial converter 40 disposed before the filter 44. Although a filter is disclosed, since the filter is connected to a parallel-to-serial converter, it is implied that Hyll uses only one filter and does not output "a plurality of signals," as

required by claim 29. Thus, Hyll and Hayashino, even combined, fails to disclose every limitation of claim 29 and its dependent claims.

Since Hyll and Hayashino, even combined, do not teach or suggest every limitation described in the claims, the references fail to establish a prima facie case of obviousness. Thus, the rejection is untenable and should be withdrawn.

Objection under 35 U.S.C. § 112, second paragraph is traversed

Claims 1-4, 9, 14, 28 and 29 were objected under 35 U.S.C. § 112, second paragraph, as being indefinite for lacking antecedent basis. By this amendment, the claims are amended to provide proper antecedent basis. Therefore, the claims are now in good form for allowance. Favorable consideration is respectfully requested.

CONCLUSION

Therefore, the present application claims subject matter patentable over the references of record and is in condition for allowance. Favorable consideration is respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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REPLACEMENT VERSION OF AMENDED CLAIMS

Subd Y

1. A sender for use in a communication system in which a sender and a receiver are connected to each other via a transmission line, said sender comprising:

a sending signal generating means for converting an input signal into carrier signals non-interfering with each other, and then outputting said carrier signals; and

a selection control means for controlling intensity distribution of said carrier signals according to transmission characteristics of said carrier signals detected on the receiver side.

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2. A sender as defined in claim 1, wherein said sending signal means includes:

a carrier signal generating means for generating a plurality of carriers; and

a multiplying means for multiplying said carriers to generate said carrier signals by the input signal and sending said carrier signals on a transmission line.

3 ~~4~~. A sender as defined in claim 2, wherein said sending signal generating means are provided with said input signal that modulates said plurality of carriers, and the sender further comprises a sending signal synthesizing means for synthesizing the outputs from said sending signal generating means.

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4 ~~6~~. A sender as defined in claim 2, wherein said selection control means selects one of said carriers to be put to said carrier signal generating means.

5 ~~7~~. A sender as defined in claim 2, wherein said selection control means provides a uniform distribution mixing ratio among all the carriers to be put to said carrier signal generating means.

B3

6 ~~8~~. A sender as defined in claim 2, wherein said selection control means provides a weighted distribution mixing ratio among all the carriers to be put to said carrier signal generating means on the basis of the transmission line characteristics of the respective carrier signals received by the receiver.

Sub D7 9. A sender for use in a communications system in which the sender and a receiver are connected to each other via a transmission line, said sender comprising:

a sending signal generating means for converting an input signal into a plurality of carrier signals non-interfering with each other both on the axis of frequency and the axis of time and outputting the converted signals; and

a selection control means for controlling intensity distribution of said carrier signals according to transmission characteristics of said carrier signals detected on the receiver side.

B3 Cont.

10. A sender for use in a communications system in which the sender and a receiver are connected to each other via a transmission line, said sender comprising:

an encoder for dividing an input signal into a plurality of divided input signals;

a plurality of filters, with said plurality of divided input signals as input, for outputting a plurality of signals, said plurality of signals free from interfering with each other both on the axis of frequency and the axis of time; and,

a sending signal synthesizing means for synthesizing the outputs of said filters.

Sub C7 14. A receiver for use in a communication system in which a sender and a receiver are connected to each other via a transmission line, said receiver comprising:

a transmission line characteristics measuring means for receiving carrier signals that the sender send in after converting an input signal into said carrier signals and for determining transmission line characteristics in respective frequency bands for said carrier signals; and

B4

a receiving signal synthesizing means for synthesizing the outputs of said transmission line characteristics measuring means;

wherein said carrier signals are generated based on the same input signal.

15. A receiver as defined in claim 14, wherein there is further provided a selection control means for controlling the intensity distribution among said carrier signals in synthesizing carrier signals at said receiving signal synthesizing means on the

B5

basis of the transmission characteristics on said transmission line of the respective carrier signals determined by said transmission line characteristics measuring means.

16. A receiver as defined in claim 15, wherein said selection control means selects signals to be put to said receiving signal synthesizing means from said carrier signals.

17. A receiver as defined in claim 15, wherein said selection control means provides a uniform distribution mixing ratio among all the carrier signals to be put to said receiving signal synthesizing means.

18. A receiver as defined in claim 15, wherein said selection control means provides a weighted distribution mixing ratio among all the carrier signals to be put to said receiving signal synthesizing means on the basis of the transmission line characteristics of the corresponding carrier signals.

19. A receiver as defined in claim 14, wherein a transmission line characteristics measuring means determines the signal intensity of said carrier signals received.

21. A receiver as defined in claim 14 wherein a transmission line characteristics measuring means determines both the signal intensity of said carrier signals received and the relative phase of said carrier signals received in relation to a reference phase.

22. A receiver as defined in claim 19, wherein said selection control means has a lower threshold value and/or upper threshold value stored therein and selects the carrier signals having signal intensity over said lower threshold value and/or said upper threshold value.

23. A receiver as defined in claim 21, wherein said selection control means has a lower threshold value and/or upper threshold value stored therein and selects the carrier

signals having signal intensity over said lower threshold value and/or said upper threshold value.

B4 Cont.

~~24~~ 18. A receiver as defined in claim ~~20~~ 17, wherein said selection control means has threshold values defining a phase range stored therein and selects the carrier signals having relative phase value within said threshold value range.

~~25~~ 21. A receiver as defined in claim ~~25~~, wherein said plurality of filters are provided for said carrier signals so formed on the sender side not to interfere with each other both on the axis of frequency and the axis of time, the central frequencies of said plurality of filters being frequencies of said carrier signals and said filters letting through said carrier signals which will not interfere with each other both on the axis of frequency and the axis of time.

Subc3 B5

28. A communication system in which a sender and a receiver are connected to each other, wherein the sender has:

a carrier signal generating means for generating a plurality of carrier signals with different frequencies based on an input signal; and,

a multiplication means for sending out on a transmission line said carrier signals modulated by said input signal; and,

wherein the receiver is provided with:

a transmission line characteristics measuring means for receiving the carrier signals modulated by said input signal from the sender and for determining transmission line characteristics in respective frequency bands of said carrier signals; and

a receiving signal synthesizing means for synthesizing said carrier signals on the basis of the transmission line characteristics.

subD47

29. A communication system in which a sender and a receiver are connected to each other, wherein the sender has:

an encoder for dividing an input signal into a plurality of divided input signals,

a plurality of filters for, with said plurality of divided input signals as input, outputting a plurality of signals, said plurality of signals satisfying the orthogonal requirements both on the axis of frequency and the axis of time; and

a sending signal synthesizing means for synthesizing the outputs of said filters and generating a plurality of carrier signals,

and wherein the receiver comprises:

a transmission line characteristics measuring means for receiving said plurality of carrier signals and determining transmission line characteristics in the respective frequency bands of said plurality of carrier signals; and

a receiving signal synthesizing means for synthesizing said plurality of carrier signals on the basis of the measurement results by said transmission line characteristics measuring means.

30. A communication system as defined in claim 28, further comprising a selection control means for controlling said receiving signal synthesizing means with regard to the intensity distribution at the time of transmission among said plurality of carrier signals on the basis of the transmission characteristics on said transmission line of the respective carrier signals.

33. A communication system as defined in claim 28, wherein said sender includes a sending signal generating means comprising a carrier signal generating means and a multiplication means for each of said plurality of divided input signals, and furthermore with a sending signal synthesizing means for synthesizing the outputs from the respective multiplication means.

34. A communication system as defined in claim 29, wherein said encoder in said sender selects a carrier to allot for each of said plurality of divided input signals.

~~35~~ 36. A communication system as defined in any of claims ~~30~~ 34, wherein said selection control means selects carrier signals to synthesize on the basis of the transmission line characteristics.

26 24
~~37~~. A communication system as defined in any of claim ~~30~~, wherein said selection control means provides a uniform distribution mixing ratio among said plurality of carrier signals.

27 24
~~38~~. A communication system as defined in any of claims ~~30~~, wherein said selection control means provides weighted distribution in the mixing ratio among said plurality of carrier signals on the basis of the transmission line characteristics of the respective carrier signals.

30 29
~~39~~. A communication system as defined in claim ~~35~~, wherein said transmission line characteristics measuring means determines the signal intensities in said carrier signals received by the receiver.

B7 Cont.

35 29
~~40~~. A communication system as defined in claim ~~35~~, wherein said transmission line characteristics measuring means determines the relative phase in said carrier signals received by the receiver in relation to a reference phase.

37 29
~~41~~. A communication system as defined in claim ~~35~~, wherein said transmission line characteristics measuring means determines both the signal intensities and the relative phase in said carrier signals received by the receiver in relation to a reference phase.

31 30
~~42~~. A communication system as defined in claim ~~39~~, wherein said selection control means has a lower threshold value and/or upper threshold value stored therein and selects the carrier signals having signal intensity over said lower threshold value and/or said upper threshold value.

38 37
~~43~~. A communication system as defined in claim ~~41~~, wherein said selection control means has a lower threshold value and/or upper threshold value stored therein and

selects the carrier signals having signal intensity over said lower threshold value and/or said upper threshold value.

36 35
~~44~~. A communication system as defined in claim ~~40~~, wherein said selection control means has threshold values defining a phase range stored therein and selects the carrier signals having relative phase within said threshold value range.

B7 cont

39 37
~~45~~. A communication system as defined in claim ~~41~~, wherein said selection control means has threshold values defining a phase range stored therein and selects the carrier signals having relative phase within said threshold value range.

33 32
~~48~~. A communication system as defined in claim ~~46~~, wherein said plurality of filters are provided for the carrier signals so formed on the sender side as to satisfy orthogonal requirements other both on the axis of frequency and the axis of time, the central frequencies of said plurality of filters being frequencies of said carrier signals and said filters satisfying orthogonal requirements both on the axis of frequency and the axis of time.

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